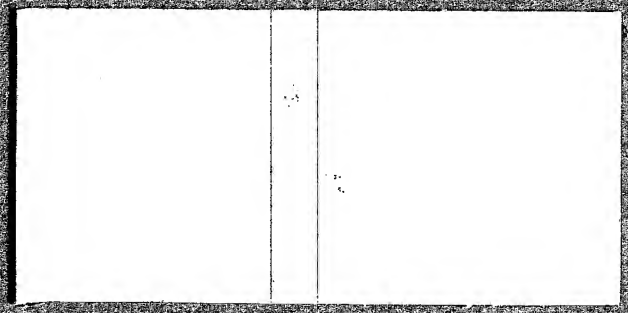

MECHANICAL DIVISION

General Mills

TO WIDER WORLDS THROUGH ... RESEARCH • CREATIVE ENGINEERING • PRECISION MANUFACTURING

15 October 1959

EB-133E
File Copy

FINAL PROGRESS REPORT

'59

HOT AIR BALLOONS

Prepared for:

Office of Naval Research
Department of the Navy
Washington 25, D. C.

Under Contract Number:

Nonr 1589(05)

25X1

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GMI Report No. B-1080

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I. INTRODUCTION

This report covers work done on this project for the period from Progress Report No. 2 or from August 1, 1958 through the contract expiration date of August 31, 1959.

The work during this period will be discussed under the following headings:

1. Materials Research
2. Hot Air Balloon Tests and Operations
3. Miscellaneous Activities

Because of lack of funds activity was suspended from August 1, 1958 through October 13, 1958.

II. MATERIALS RESEARCH

Upon resumption of project activity in October 1958 the first work was done on the selection of material for a second hot air balloon. The film used in the first prototype balloon was a metalized mylar laminate manufactured by the Griffolyn Co. of Madison, Wisconsin.

This material was quite satisfactory but its cost was high. It required approximately $2200.00 worth of material to build one balloon. The quality of this material also was very inconsistent, the edges being very irregular and the cross threads bunched up in many areas.

A trip was made to the Dobeckmun Company of Cleveland, Ohio and to the film division of the Continental Can Company in Mt. Vernon, Ohio. Both of these companies agreed that they could manufacture a film similar to the Griffolyn film.

Because Dobeckmun was able to make the earliest delivery they were

given an order for enough material for the second 39 foot hot air balloon. Samples of the three films considered are attached in the appendix. No. 1 is the Griffdyn film, No. 2 is the Dobeckmun film and No. 3 is the Continental Can film.

The Griffolyn film is laminated with fortisan threads and the other two have fiberglass threads.

The fiberglass threads are more resistant to prolonged exposure to heat than are the fortisan fibers. Subsequent inflations and exposures to high temperatures rendered the threads in the first balloon useless for preventing the tearing of the mylar.

The material purchased from Dobeckmun had the metalized layer on the inside next to the fiberglass fibers to protect it from corrosion by the acidic moisture produced by the burning propane gas. While this protected the metalizing, much of the reflective insulation value of this coating was believed lost and this is not recommended for an operational unit.

The original material from Griffolyn had the metalized layer on the inside of the balloon and experiments indicated that this was more desirable.

After repeated exposures to the acidic atmosphere inside the balloon the metalized coating on the Griffolyn material disappeared on many areas thus reducing its effectiveness.

Neither the Griffolyn nor the Dobeckmun film were difficult to fabricate. Both materials were sealed by the same method.

The primary seal joining the gores together was made using Minnesota Mining No. 466 transfer tape. This seal was reinforced by two inch widths of No. 853 Minnesota Mining pressure sensitive mylar tape. The balloon made

from the Griffolyn material was taped along the gore seams both inside and outside while the balloon made from the Dobeckmun material was taped only on the outside.

In all the tests conducted with both balloons no seam failures were experienced.

III. HOT AIR BALLOON TESTS

During the past year a number of indoor and outdoor tests were made of the hot air balloon system.

An indoor test was made November 18, 1958 and data from this test was included in the last progress report notwithstanding the fact that this test was made after that report period.

The first outdoor test was made the morning of January 8, 1959 from our flight center near New Brighton, Minnesota.

The original metalized balloon was used for this test. The purpose of this test was to familiarize the men with the balloon system and to test the use of the new rapid deflation device.

The inflation period was timed during this test and it was found that we were able to generate heat fast enough to have a man airborne within 21 minutes after inflation was started.

The deflation device was successfully proven for the first time during this flight.

Another outdoor test was made from the same location in early February 1959. The test had to be terminated soon after the inflation was completed due to increasing surface winds.

Photograph No. 1 was taken during this flight and shows the balloon

at the beginning of the deflation period. This picture was taken immediately after the top of the balloon was released as the balloon descended.

The second metalized mylar balloon was completed the first week in March and its first test was scheduled March 17, 1959.

The test of this balloon has to be cancelled as the lower portion of the balloon was damaged severely by fire during inflation.

This was the first test of the balloon manufactured from the Dobeckmun material.

The fire destroyed approximately 25 square feet of material around the bottom end fitting. This damage was later repaired.

There was no activity during April because of lack of funds for the project.

The second outdoor test was made using the "Dobeckmun" balloon on May 8, 1959 at the airport at Mankato, Minnesota. Considerable time was spend during this test familiarizing the crew with the operation of the system. A free flight was not attempted at this time as the trajectory was directly over the downtown area of Mankato. The pilot felt he was not familiar enough with the operation of the system in order to act in case of an emergency which could likely happen while over the city. A modified type of end fitting was used at this time and worked successfully in deflating the balloon upon completion of the test.

Another flight was attempted during July in the presence of a representative from the sponsor's office. The original "Griffolyn" balloon was used for this test but it was so severely damaged by surface winds during inflation that a flight could not be made and the flight was terminated.

This was the ninth time that this balloon had been inflated and used for testing. The threads had been so weakened from the previous tests that in the surface winds encountered the balloon was ruptured and torn extensively.

The last flight attempt was made August 31, 1959 at the Lake Elmo, Minnesota Airport.

The "Dobeckmun" balloon was used for this test.

High surface winds were encountered during this test and it was not possible to generate enough free lift to launch the flight.

Pictures Nos. 2 and 3 were taken during this test. Picture No. 4 shows the balloon after the top end fitting had been released to terminate this test. Because of the contract termination, the operational activity was suspended with this last test.

IV. OTHER TASK DEVELOPMENTS AND ACTIVITIES

During the past year there were other activities that were carried on under this contract.

They include:

1. Completion of a 20 foot polyethylene balloon for the sponsor that had been held in storage by General Mills, Inc.
2. The purchase and shipment of four special storage containers at the request of the sponsor.
3. The design and construction of a special one man gondola.
4. Testing and reporting on 14 polyethylene samples submitted by the sponsor.
5. The design and installation on item No. 1 of a special moisture drain incorporated in the end fitting.

6. The redesign and construction of the second hot air balloon.

7. The development and testing of the rapid deflation end fitting device.

8. Development and preliminary testing of a pressurized torus within the hot air balloon. This inflatable torus was installed just above the vent openings and fastened to the inside of the balloon. Its purpose was to hold the balloon wall away from the flame during inflation to prevent damage to the balloon.

   Only one test was made using this device and since insufficient pressure could be provided during this test no conclusive information on its use could be obtained.

V. SUMMARY AND CONCLUSIONS

The activities under this contract have progressed for the past three and one half years.

There have been many tasks and developments made that have been reported in previous reports. This report summarizes the work that had been done during the past year and this has been limited mainly to work on the "Hot Air" system. A significant development for this period was the invention and testing of the "quick release" top end fitting that enables the pilot to deflate the balloon almost immediately upon landing. In case of adverse surface winds this would prevent dragging of the balloon and gondola and possible injury to the pilot.

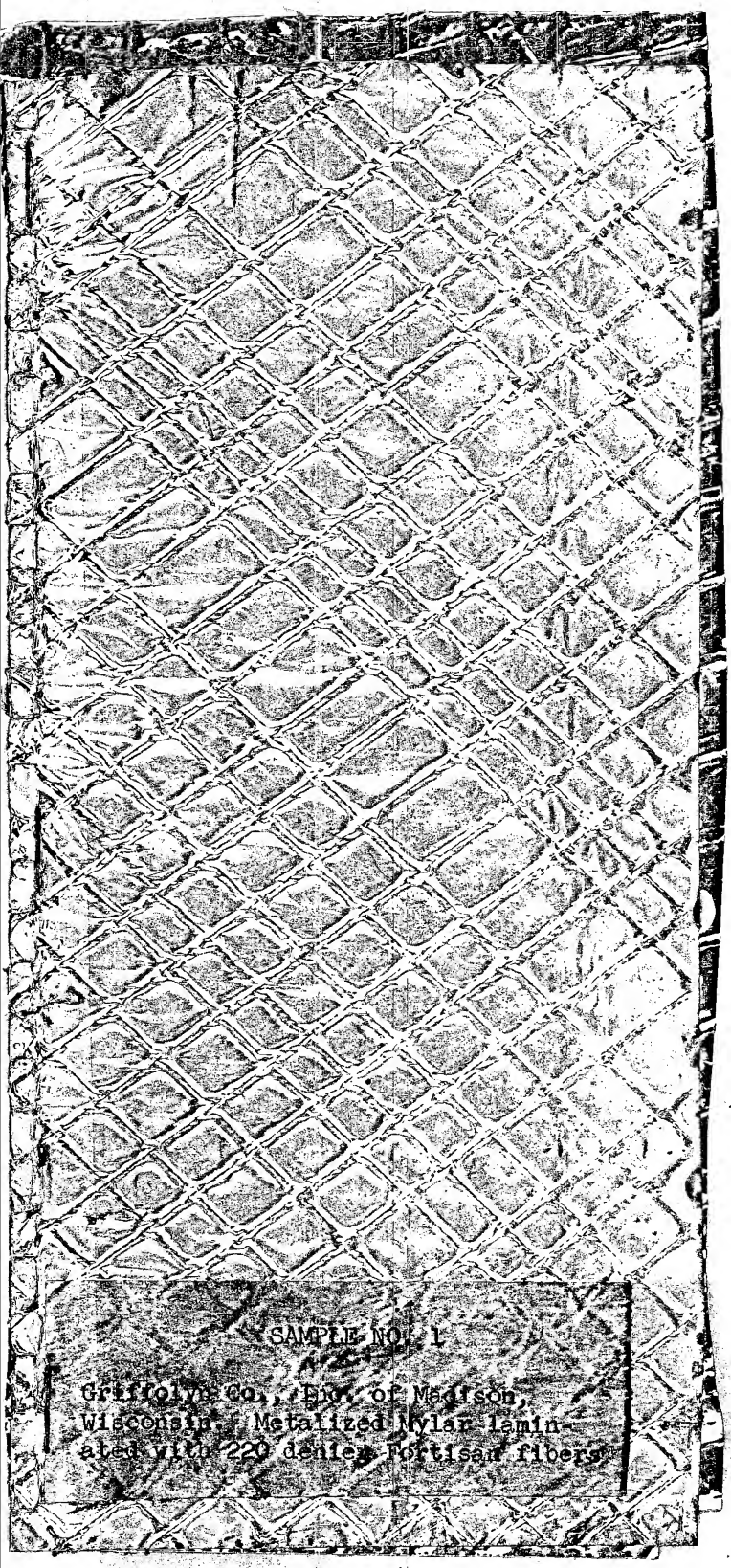
When used with the present mylar laminate balloon, described in drawing C-231833 in the appendix, it will lessen the chance of unrepairable damage

to the balloon thus enabling it to be used more than once.

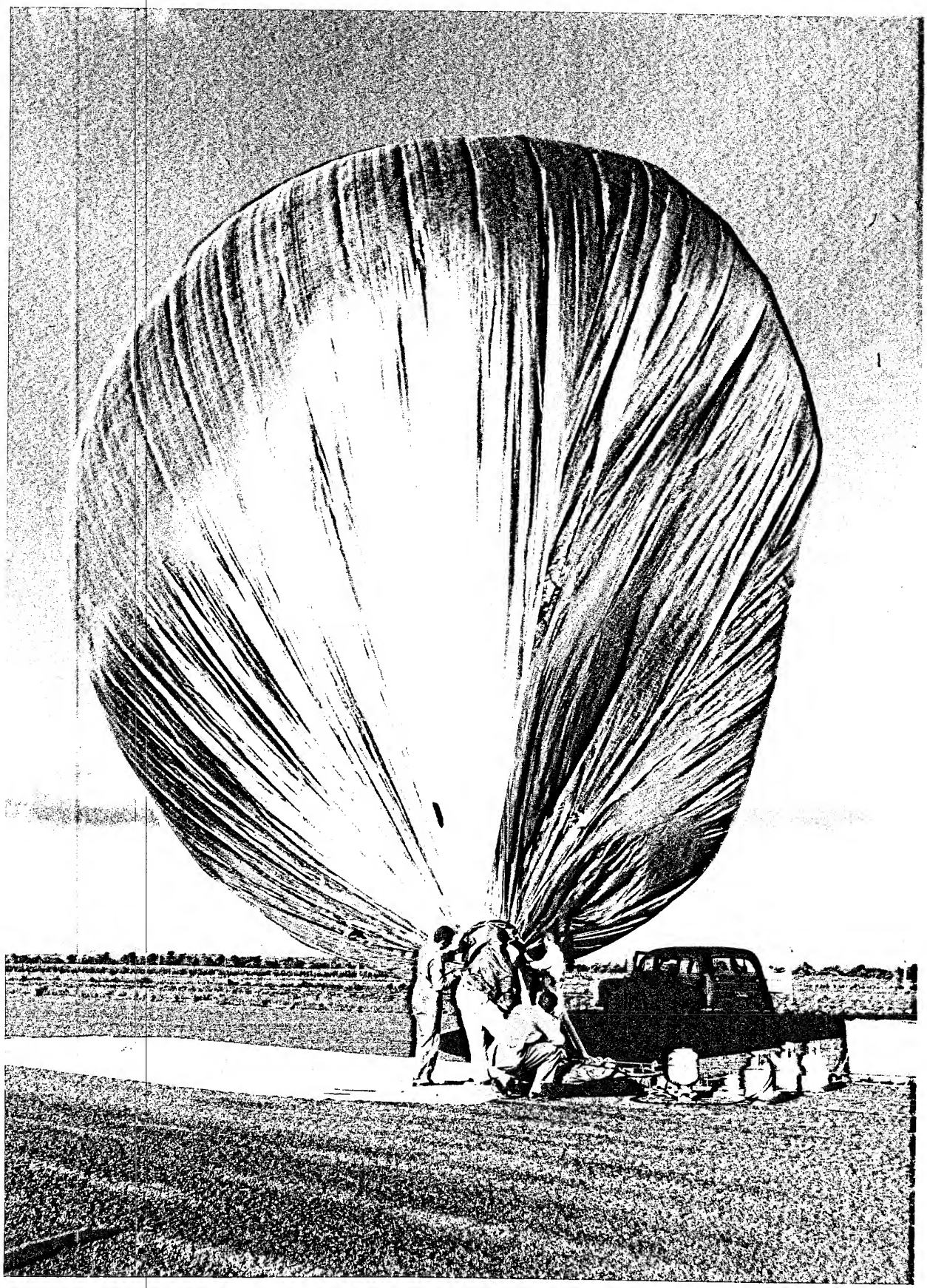
A burner has been developed that is light and still has a very high output. It is not believed that the ultimate in burner design has been approached during the scope of this project but that the development to date has pointed toward a very good method of producing heat for this type of a device.

Repeated tests have shown that the present Hot Air System is basically sound and it is believed that with further minor improvements a very versatile unit could be developed that would require the very minimum logistic support.

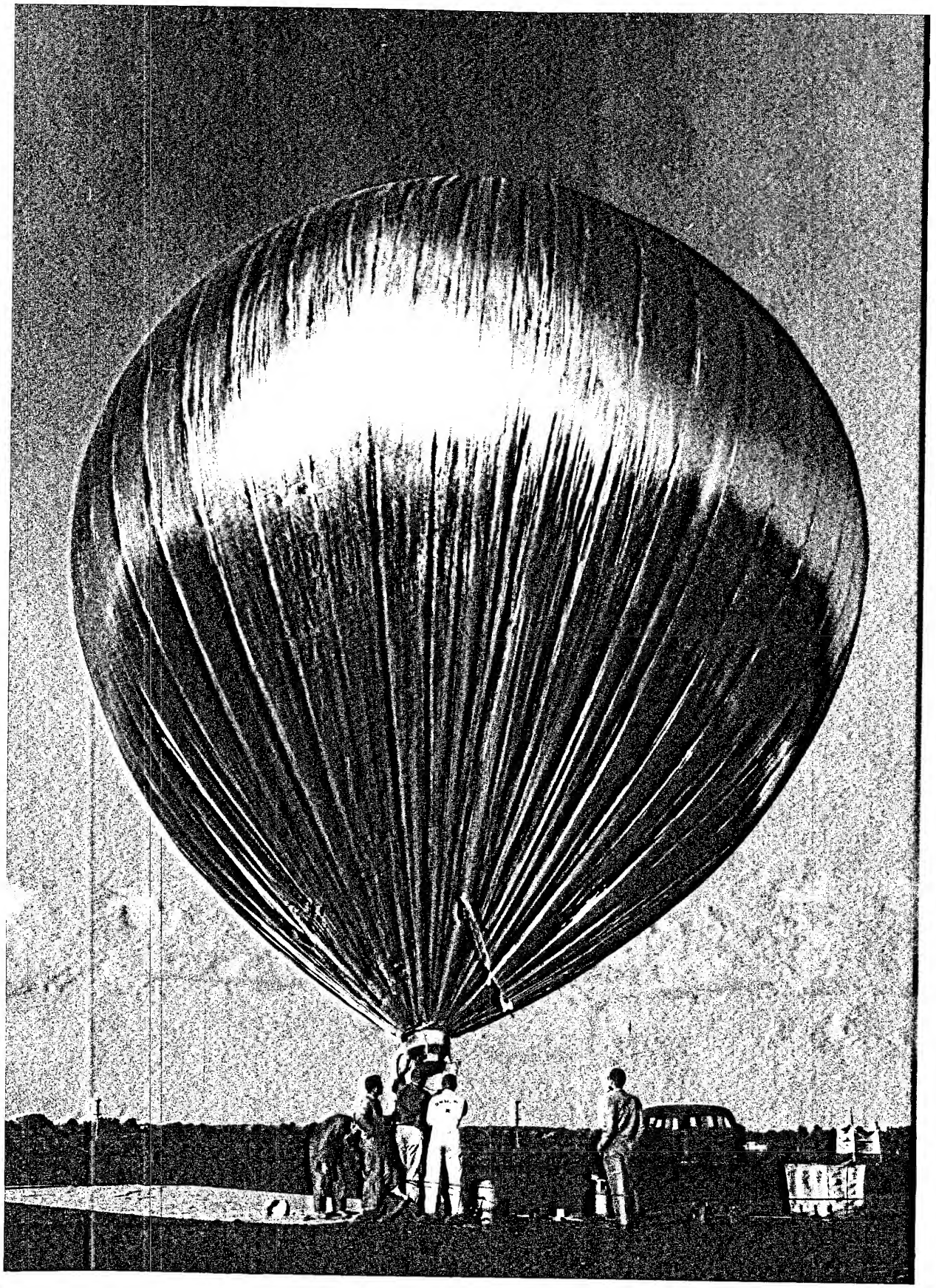
Appendix



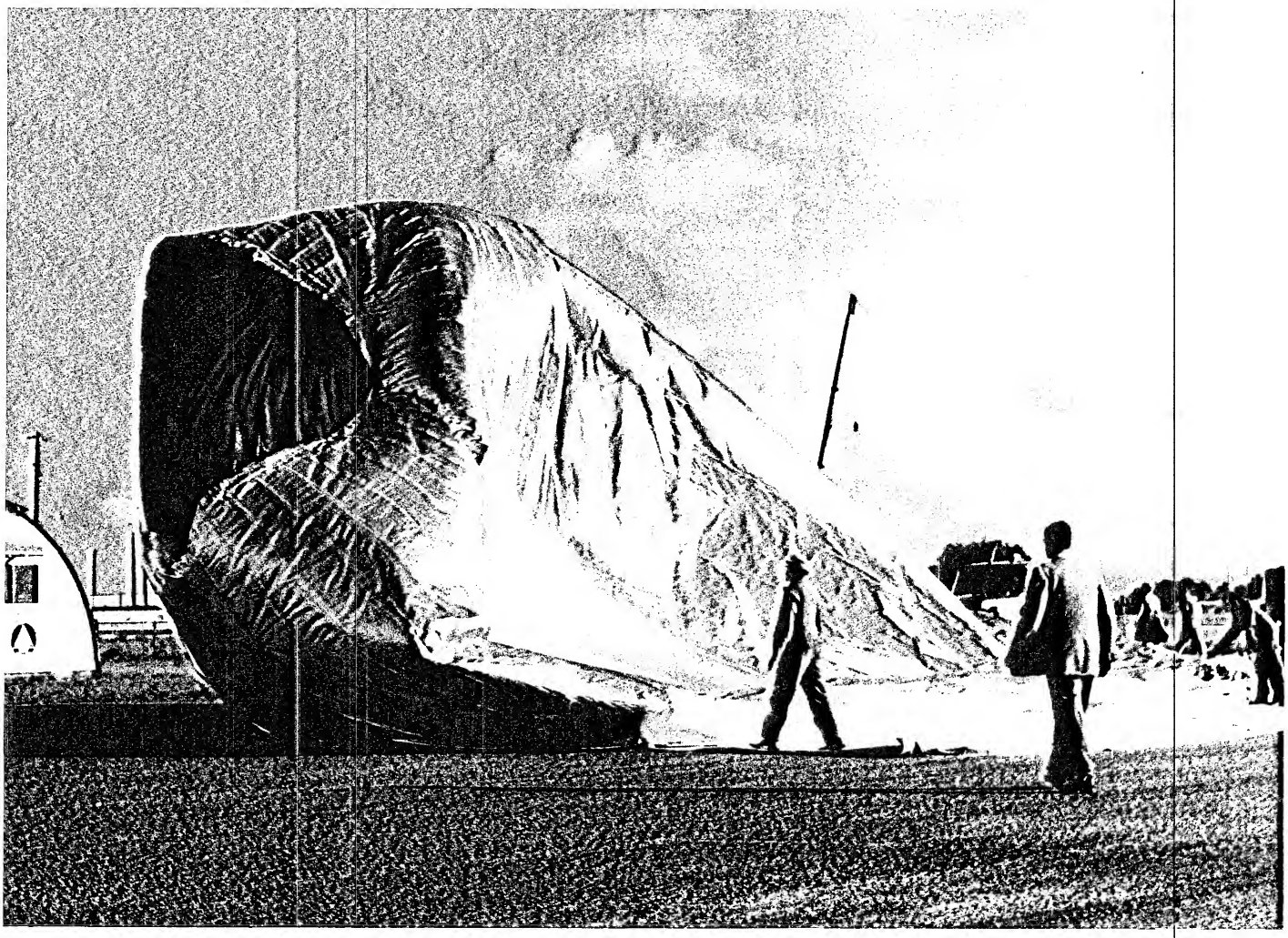
Balloon beginning deflation after
release of end fitting



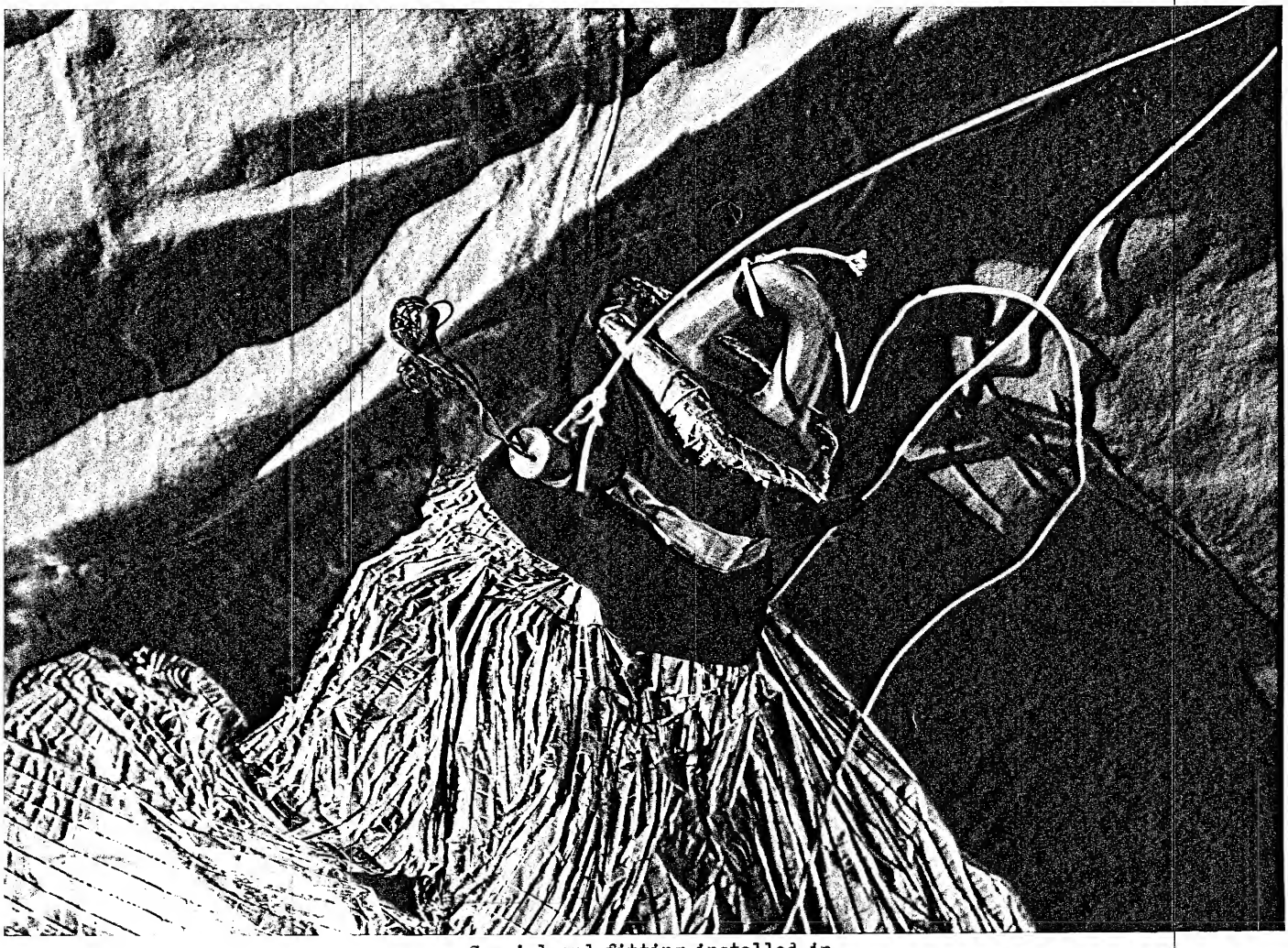
Inflating balloon under windy conditions



Balloon almost fully inflated
under calm conditions



Balloon nearly deflated seconds
after release of end fitting

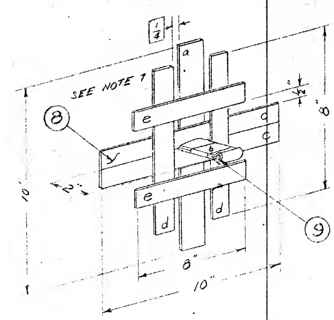


Special end fitting installed in
top of "Hot Air" balloon

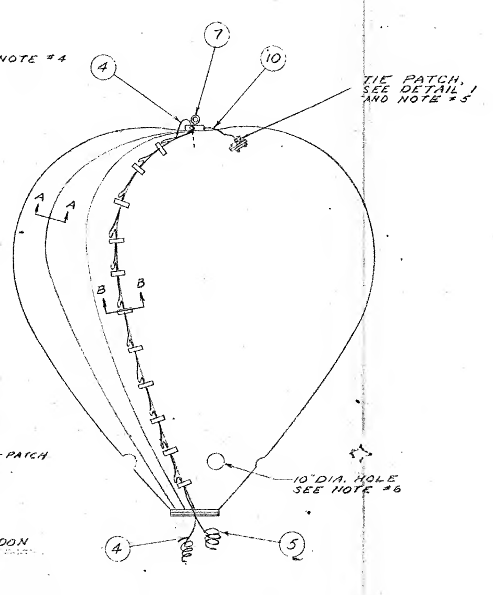
REVISIONS					
SYM	ZONE	ECO NO	DESCRIPTION	DATE	APPROVAL
		7-1006	NEW RELEASE	1/5/57	

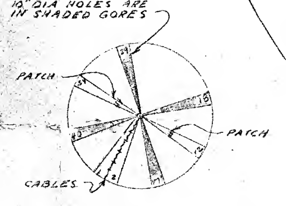
NOTES:

1. THE METALIZED SIDE OF ITEM #1 SHOULD BE ON INSIDE OF BALLOON.
2. CARE SHOULD BE EXERCISED TO ELIMINATE AIR POCKETS WHEN APPLYING TAPES, ITEMS 2 & 3.
3. THE CABLES, ITEMS 4 & 5 SHALL BE ATTACHED TO BALLOON SEAM WITH ITEM #6 AT 5FT. INTERVALS ALLOWING 8% FULLNESS & 4' AT BOTTOM.
4. ITEM #4 SHALL EXTEND THROUGH THE TOP END FITTING & INTO THE BALLOON FOR A DISTANCE OF 6".
5. POSITION TWO TIE PATCHES 3FT FROM TOP MARK LINE, ONE ON ℄ OF GORE #12 & ONE ON ℄ OF GORE # 34
6. CUT FOUR 10" DIA. HOLES 6FT. FROM BOTTOM MARK LINE & ON ℄ OF GORES # 7, 18, 29, & 40, REINFORCE EACH HOLE ON BOTH SIDES WITH ITEM 3 TO A DISTANCE OF 3" FROM THE EDGE.

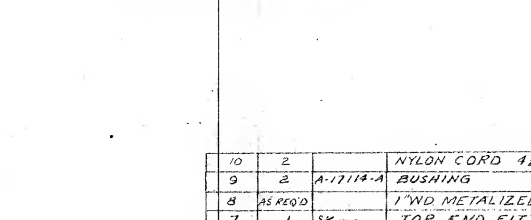


1. DETAIL OF TIE PATCH

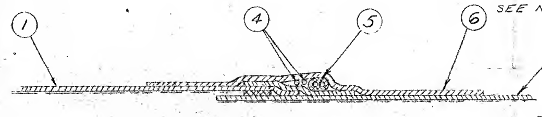




TOP VIEW OF BALLOON



SECTION A-A



SECTION B-B

231833
SHEET 1 OF 1

OCT 9 1959

ITEM	QUAN	PART NO.	DESCRIPTION
10	2		NYLON CORD 4½ FT LG., 200# TEST
9	2	A-17114-A	BUSHING
8	AS REQ'D		1" WD METALIZED MYLAR TAPE PERMACEL #951
7	1	SK —	TOP END FITTING (EXPERIMENTAL)
6	AS REQ'D		MYLAR TAPE, 2"x6", 3M # 853
5	1		CABLE, 2 COND., 70'-LG
4	1		THERMOCOUPLE WIRE, 70' LG.
3	44		MYLAR TAPE, 2"x60', 3M # 853
2	44		TRANSFER TAPE, 3M #466, ½"x66'
1	44		GORE, METALIZED LAMINATED MYLAR

LIST OF MATERIALS

ADDITIVE FINISH

MATERIAL

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
TOLERANCES: FRACTIONS / DECIMALS / ANGLES / RADII
in.-± 1/4"
ft-± 6"

HEAT TREATMENT

DR R.J.W. — ENGR R.J.W.
CHK WJH — APPD [illegible]
ORIGINAL DATE OF DRAWING 1/8/57
APPLICABLE SPECIFICATIONS

NAME: BALLOON ASS'Y 39-1-3 HOT AIR

General Mills, Inc.
MECHANICAL DIVISION
1620 CENTRAL AVENUE N. E.
MINNEAPOLIS, MINNESOTA

DWG SIZE C — DWG NO 231833
SCALE NONE — UNIT WT
SHEET 1 OF 1